Encounter, Story and Dance: Human-Machine Communication and the Design of Human-Technology Interactions

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ABSTRACT

John McCarthy and Peter Wright argue that people "don't just use technology;" they "live with it," which drives their decision "to suggest an approach to viewing technology as experience," rather than theorizing people's "experience with technology" [8]. This paper takes a step back, to reconsider the potential of analyzing what people do *with* technology, because some technologies, in particular robots, are increasingly experienced as machine others, *with which* people are encouraged to collaborate, as opposed just to use. Recognizing the work of McCarthy and Wright, the paper takes the threads of experience they identify—sensual, emotional, compositional and spatio-temporal—and examines these alongside a broad communication-theoretical approach that identifies three interlocking elements in human-robot interactions: encounter, story and dance [11]. This framework is identified as one approach being developed within a new area of communication studies, Human-Machine Communication (HMC). The paper argues that attending to the detail of how humans and robots communicate in relation to encounters, stories and dances, supports recognition of the complexities of experience within human-robot interactions that support flexible modes of human-robot collaboration. In particular, this framework is open to the potential of machine-like robots in human-robot interactions for which a process of "tempered anthropomorphism" supports meaningful communication with a robot that is nonetheless clearly recognized by people as a machine other [11].

CCS CONCEPTS

• **Human-centered computing~Interaction design theory, concepts and paradigms** • *Human-centered computing~Collaborative interaction* • *Human-centered computing~HCI theory, concepts and models*

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KEYWORDS

Human-Machine Communication, HMC, Human-Robot Interaction, HRI, Communication Theory, User Experience, UX, Encounter, Story, Dance

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1 Introduction

It is only very recently that attempts have been made to establish Human-Machine Communication (HMC) as a specific area of research, positioned within the field of communication studies more generally [4]. This paper explores how HMC research offers a way to extend the work of User Experience (UX) researchers and designers. Thinking about human-technology interactions in terms of the approach to HMC identified below supports the need to set aside analyses that position humans as users and machines as tools, to adopt a more flexible understanding of human-machine relations as designed to support collaborations within which both human and machine are regarded, in their own specific ways, as active participants.

Communication between humans and machines is often framed in terms of information exchange in precise, clear language. This perspective on HMC has long been seen in people's use of computer programming languages, but increasingly it can also be recognized in discussions about the use of human language in text and voice interfaces for digital assistants and personal robots. Alongside this, an embodied form of well-coded information can also be seen in the use of easy to recognize signs, such as traffic lights and pedestrian signals, as well as many standard aspects of computer interface design, such as undo and redo toolbar icons.

Analyses of communication that concentrate on the coding necessary to enable the exchange of precise information are most often associated with a cybernetic-semiotic perspective on communication [11]. However, a broader consideration of HMC is made possible by considering other communication-theoretical

traditions, such as sociopsychological (communication as persuasion), sociocultural (communication as the means by which shared understandings of the world are created and negotiated) and phenomenological (communication as openness to otherness) [11].

Accepting a broad understanding of what constitutes communication supports the identification of three interlocking elements in human-machine interactions: encounter, story and dance. In this paper, a specific human-robot interaction is analyzed from various theoretical perspectives on communication, to demonstrate how these three elements operate and interrelate to one another. In addition, the paper considers how this way of understanding HMC works alongside the themes in user experience that McCarthy and Wright identify—sensual, emotional, compositional and spatio-temporal [8]—to draw out how humans and robots may, in some cases at least, be best seen as operating collaboratively together, such that human and robot are attuned to attending to each other's understanding of the world and task at hand.

Although McCarthy and Wright first formulated their framework for understanding user experience in 2004, in 2018 McCarthy, Wright and Meekison note they feel no need to revise the theory [9], and their approach is still recognized as valuable in relatively recent interaction design texts [10].

2 Interactions with Vyo

Vyo is a research robot, designed by a collaborative team of people from IDC Herzliya, Cornell and SK Telecom. It has been created as an experimental interface to test people's responses to a novel way of interacting with a smart home. The appearance of this robot is very different from other home or personal robots, sometimes designed to be "cute" (as seen with Jibo, for example) and often with voice recognition and conversation algorithms that allow them to communicate in as humanlike a way as possible (a feature of Jibo, but also the less cute and currently more functional Google Home and Amazon Echo). Vyo is an experimental platform and does have a voice interface, but in most interactions demonstrated with this robot it is embodied communication channels that seem far more important.

2.1 Overview

Vyo is "an expressive social robot" that acts as an "embodied interface for smart-home control." This robot's design was "inspired by a microscope metaphor" [7]. Vyo's form gives it clearly identifiable "body," "neck," and "head" sections (see Figure 1). This allows the robot to raise its head when people approach, "looking" at them with its single camera "eye." Vyo only initiates engagement with people if there is something wrong with one of the home systems or appliances it is monitoring. When all is well with the smart home, it is up to people to engage the robot in communication and, if the person who approached continues on past the robot, it simply looks back down and continues with its tasks.

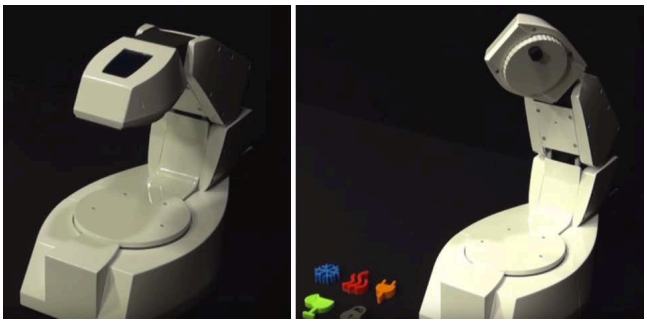

Figure 1: Still images of Vyo from video available here: https://www.youtube.com/watch?v=pi3fAyNyClw

When people decide to communicate with Vyo they can choose to use a voice interface, but much of people's communication with this robot is silent, being embodied through the use of small physical icons, or "phicons," each of which represent a particular home system or appliance. To request information about the home, a person chooses the relevant phicon and places this on the status platform to the front of Vyo's "turntable" (the part of the robot that mimics a microscope stage). The robot bows its head to examine the phicon, while also revealing a small visual display on the back of its head. Vyo confirms its recognition of the chosen phicon by showing a matched icon on the screen with status information where available, such as temperature for the heating or cooling system.

Placing a phicon on the main part of the turntable signals that a system or appliance should be activated, although Vyo is shown as intelligently assessing when to run the dishwasher, for example, to coincide with a cheaper electricity supply. For some systems, moving the phicon up and down the turntable alters a setting, such as turning the thermostat up and down for preferred room temperature. When this is done, the small screen shows the change in value associated with the phicon's movement.

Vyo only actively engages people in communication when something is wrong in the smart home. It does this by using embodied communication, with gestures designed to attract a person's attention at two levels. The first involves a change in its normal calm up and down "breathing" motion of the head and neck to become "a nervous breathing gesture" [6]. This movement is designed to attract attention in the peripheral vision of a person, to indicate that there is a non-urgent issue in the home that needs their attention when they have time. The second gesture is one of "urgent panic," as Vyo begins "looking around" with what is easily read as an air of desperation [6]. This obvious movement is designed to attract an immediate response from anyone in the vicinity of the robot.

2.2 Encountering Vyo

Although quite subtle and understated, from a cybernetic-semiotic perspective on communication the movement Vyo exhibits when a person approaches can simply be read as a clear signal that the robot is paying attention to the human's presence.

Alongside this, the effect as the robot turns its "face" towards the person can be analyzed in stronger terms from a phenomenological perspective. Emmanuel Levinas theorized "the face to face" as an encounter between humans, during which the self and other are drawn into proximity and yet also remain irrevocably distanced from each other by a level of absolute difference [5]. In spite of the fact that Levinas himself would not have considered machines able to take part in such an encounter, the movement of Vyo, as it turns to "look" at a person who approaches, encourages them to recognize this robot as an alert and attentive "other" with which they might usefully interact.

Vyo's movement is anthropomorphized by people as "looking" at them, but, alongside this, the otherness, or non-humanness, of Vyo is also retained, being clearly conveyed through its non-anthropomorphic design. Encounters with Vyo therefore establish the potential for a process of what can be termed "tempered anthropomorphism" [11], where the attribution of human characteristics onto the robot assists meaning-making in interaction, but this process is tempered by the strength with which the form and other behaviors of the robot convey its machine-like nature.

From a phenomenological perspective on communication, Vyo's quiet attentive presence is encountered as an overt otherness in the home. The idea of encounter, and the phenomenological experience of otherness, can be closely associated with McCarthy and Wright's sensual theme [8], as a pre-reflective, immediate, concrete and visceral experience, but extends this to highlight how a human is encouraged to respond to such a robot as an active and attentive occupant of a shared space.

2.3 Stories and Vyo

A story frame for understanding this robot is communicated through its very form. Vyo's resemblance to a microscope marks it as relatively unconventional in a home, setting the robot apart from other household objects. Although unusual in the home, in laboratories microscopes are familiar, safe and predictable scientific instruments. Vyo's design therefore helps make it seem "reliable, reassuring and trustworthy" [6]. Vyo is a microscope on the smart home, inviting people to interact with it in order to gain more detailed information about an aspect of their domestic setting. As one of its designers notes, the screen on the back of Vyo's head is a "physical pun," suggesting people can "look into the robot's thought process" [1]. Of course, Vyo is also capable of actively monitoring systems constantly and autonomously, which is why recognizing its otherness (as part of encountering Vyo, see above) is very important if one is to recognize its attempts to communicate when issues arise.

Although Vyo is non-anthropomorphic, its resting state, and the two degrees of agitation it displays in order to attract attention when something is wrong in the home, are designed to be anthropomorphized (as was the case for its looking motion discussed above). To use Sherry Turkle's terminology, it is helpful to recognize how Vyo operates as part of a class of "evocative objects," which "invite projection" [12]. For Vyo, this projection might initially be through recognizing the potential of the robot to operate as a microscope on systems and appliances in the smart home, but the robot's embodied communication also encourages people to anthropomorphize its movements from a socio-cultural perspective to help them recognize its breathing state as indicating calm, concern or distress.

The story that frames interactions with Vyo, as well as the way readings of the robot's state are conveyed through its anthropomorphized movement, connects the idea of story in communication with McCarthy and Wright's compositional theme [8]. The elements of people's experience with Vyo are framed by prior knowledge and understanding of the use of microscopes, but also further developed through projecting the meanings of certain movements based on the human experience of being mildly or extremely worried about something. The robot is understood from a socio-cultural communication perspective as having a similar understanding of what it means to care for the home as the human occupants, expressing its concern in meaningful ways, although its non-anthropomorphic form consistently reminds people of its presence as a machine other, very different from another human.

2.4 Dancing with Vyo

This robot's interface relies a great deal on embodied communication and co-regulated movement alongside a person. The coordinated timing of its movement to look up as someone walks past supports the reading of this motion as a response and a query. Where a person interacts directly with the robot using the phicons, the choreographed movements are even more precise. As the person places a phicon, the robot looks down to inspects this closely, simultaneously revealing the screen to acknowledge the phicon's meaning and provide status information on that system or appliance. The robot's movements therefore both signal it understands the human's request and provide the required information. The flow of co-regulated movement is also clear as the human moves a phicon on the robot's turntable, resulting in a matched change in the temperature setting of the thermostat, for example, also displayed in real-time on the robot's screen.

While it might seem sufficient to discuss this type of interaction simply as embodied communication, analyzed in semiotic-cybernetic terms as direct signals between human and robot and vice versa, this may overlook the fluid potential of overlapping movement, request and response. As Alan Fogel suggests, during an embodied dance of communication such as that with Vyo, "co-regulation arises as part of a continuous process of communication, not as the result of an exchange of messages borne by discrete communication signals" [2]. This form of communication is dynamic in a way that allows "meaning making" to become an emergent outcome of the "process of engagement" between a human and a robot [3].

The spatio-temporal theme identified by McCarthy and Wright is also alert to place and time as contexts [8], drawing attention to the strangeness of interacting with a microscope-like robot in the home, while also acknowledging the sense it makes in relation to providing detailed information about the

workings of the smart-home environment shared by human and robot.

2.5 Vyo, HMC and the emotional theme

Although this paper has not yet overtly linked the emotional theme of McCarthy and Wright with HMC and the elements of encounter, story and dance identified above, this is only because the importance of emotion can be seen to flow across all three. While McCarthy and Wright focus on the way that emotion colors experience, promoting value judgements and providing ways to summarize experience for future reference as a memory [8], in this paper emotion is more closely associated with openness to the other, alongside a continually tempered use of anthropomorphism that assists human understanding of the robot's actions in different contexts.

An emotional experience is particularly noticeable when seeing the robot become slightly or very agitated, judging by my own response to the video showing its "nervous breathing" and "urgent panic" behaviors. Attending to the emotional impact of observing and, presumably, of interacting with Vyo draws attention not only to the socio-cultural frame within which its behaviors are read, but also the persuasive socio-psychological effect of its apparent distress designed to gain human assistance.

Importantly, although this robot evokes a strong emotional response at times, it does not do this simply to draw people into engaging with its personality; instead, this robot has a clear and practically important aim, to communicate that something is wrong with the smart home and requires human attention.

3 Conclusion

Unlike other some other robots, Vyo does not make attempts to engage with humans actively much of the time. This is why it seems more appropriate to view Vyo as an "evocative object" [12]. In contrast, other social robots have been described as "relational artifacts," which "demand engagement" [13]. In general, relational artifacts drive human engagement through the use of humanlike communication and expression. In contrast, Vyo's personality and "being" is much more open to interpretation. This robot is more easily read in terms of a phenomenological perspective's insistence on the importance of recognizing otherness, even as interactants are brought into close proximity through communication and joint action in a shared space. In addition, the more open the robot is to interpretation—the more it is evocative rather than forcing a particular type of relation—the more space there is for people to read emotion into the machine at a level with which they are comfortable. The advantages of this are that interactions with the robot over time are maybe less likely to become irritating, since the personality of the robot does not overwhelm its purpose in the home.

While Vyo is clearly "device-like," its behavior is framed by its context as a robot that helps manage the smart-home environment. Interactions with Vyo—understood to consist of interlocking elements of encounter, story and dance—encourage people to collaborate with this robot, rather than thinking of it as a tool to be used. The robot can seem social (engaging, respectful and reassuring) when required, but often it takes an unobtrusive background position. This flexibility of positioning, and the potential for recognizing a collaborative relation with Vyo, are drawn out through this paper's attention to the detail of how humans and this robot communicate, considering this alongside sensual, emotional, compositional and spatio-temporal themes of human experience.

Wright, McCarthy and Meekison explain their "framework was meant to de-centre information processing as the best way HCI researchers could understand 'users'," putting "people's lived experience, their feelings, values, stories and ways of making sense of their interactions with the world, at the centre of HCI enquiry" [9]. In a somewhat similar way, this paper moves beyond regarding the core goal of communication, in particular HMC, as the precision exchange of information through cybernetic-semiotic processes. Instead, the framework introduced in this paper recognizes communication within an initial encounter which is open to otherness, the situatedness of the communication (and understanding of the other, in this case the robot other) through stories, and the dynamic nature of embodied communication understood as a dance within which meaning (and a sense of the relationship between human and machine) emerges. This broad perspective on HMC might help free designers from pursuing only overtly humanlike communication styles in human-robot interactions, encouraging more creative and open designs for robots that are communicative partners with which humans can collaborate whether in homes or in other environments, while also retaining a clear sense of the machine's otherness and therefore also the particular abilities and skills it might bring to the situation.

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